

**FY 2013 Report on Monitoring and Management
of the Black-capped Vireo (*Vireo atricapilla*)
on Travis County's Balcones Canyonlands Preserve**



Photo: Black-capped Vireo, Vireo Ridge Tract (Bret Whitney)

**Travis County
Department of Transportation and Natural Resources
Natural Resources & Environmental Quality Division**



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INTRODUCTION

In the United States and Canada, 448 native bird species breed in terrestrial habitats (Rich et al. 2004). Approximately 200 of those terrestrial species, commonly known as neotropical migrants, breed in North America, and then migrate south to winter in Mexico, Central America, South America, and the Caribbean (Sibley 2001). A majority of neotropical migratory bird species face population declines due to a wide array of threats including, but not limited to, habitat loss, degradation, and fragmentation (Rich et al. 2004). Partners in Flight, the U.S. Fish and Wildlife Service (USFWS), and many other cooperating agencies are actively developing recovery and conservation plans, acquiring and protecting critical habitat, and educating the general public about bird conservation issues in order to slow or prevent further population declines.

The Black-capped vireo (*Vireo atricapilla*, hereafter BCVI, or vireo) was listed as a federally endangered species in 1987. Habitat loss and nest parasitism by Brown-headed cowbirds (*Molothrus ater*) are among the greatest threats to BCVI populations. The breeding range of this neotropical migrant has decreased markedly within the last few decades. Historically, BCVIs in the United States were found in Kansas, Oklahoma, and Texas during the breeding season (Grzybowski 1995). Presently, the BCVI breeds in a restricted range that includes: three counties in Oklahoma, portions of central and south-central Texas, and south into central Coahuila, through Nuevo Leon and into southwestern Tamaulipas, Mexico (Farquhar and Gonzalez 2005; Grzybowski et al. 1994; Grzybowski 1995, Oklahoma Dept. of Wildlife Cons. 1999; U.S. Fish and Wildlife Service 1991). Between 1996 and 2005, BCVI populations in Texas have been reported in only 38 south-central and central counties (Wilkins et al. 2006). A USFWS review of the BCVI population status was completed as required by the Endangered Species Act in 2006 (Wilkins et al. 2006).

Available BCVI habitat, and subsequently BCVI populations, in Travis County have been significantly reduced as natural disturbances, such as fire, are suppressed and suburban development continues to expand. Additionally, browse pressure from White-tailed deer (*Odocoileus virginianus*) overpopulation can negatively affect BCVI habitat structure (Grzybowski 1995). In 1996, less than 100 individual BCVIs were estimated to occur in Travis County (USFWS 1996a). More recent analyses of survey data indicate that since 2000, the BCVI population estimate in Travis County is fewer than 50 individuals (Wilkins et. al 2006).

The USFWS issued the Balcones Canyonlands Conservation Plan (BCCP) section 10(a)1(B) permit to the City of Austin and Travis County in 1996 (USFWS 1996b). The plan calls for a minimum of 30,428 acres of endangered species habitat in western Travis County to be set aside and managed within the Balcones Canyonlands Preserve (BCP or Preserve; see Figure 1). As of September 2013, the BCP encompassed 30,520 acres. A minimum of 2,000 of these acres are required to be designated as BCVI habitat. Due to changes in land use and fire suppression, most BCVI habitat will have to be maintained and/or created through habitat restoration efforts (USFWS 1996c). Currently, Travis County manages 7,704 acres designated part of the BCP.

BCVI habitat has been described as:

“low scrubby growth, mostly deciduous and of irregular height and distribution, with small spaces between the thickets and clumps, with vegetation cover to ground level. This is an early to mid-successional progression, or one maintained in edaphic (due to soil or topography) settings such as occurs in rocky gullies, edges of ravines, and on eroded slopes; thus often quite localized (Grzybowski 1995).”

Additionally BCVI habitat has been characterized as including the following:

- greater density of deciduous vegetation in height zones from 0 - 2 meters.
- average amounts of deciduous cover ranging from 30-45%, with total woody cover including Ashe juniper ranging from 36-55%.
- greater within-territory heterogeneity of vegetation structure (with shrubs closely spaced but still separated, and allowing light to penetrate to ground levels).
- openness not exceeding about 65% in older adult vireo territories (i.e. at least 35% woody cover) (Grzybowski 1995).

This report presents the results of the 2013 BCP surveys for BCVI conducted by Travis County Natural Resources personnel. Annual BCVI population data collected from Travis County-managed lands is analyzed in order to monitor changes in distribution, abundance, and productivity. Monitoring the population will help gauge the effectiveness of habitat restoration projects and prioritize sites for future restoration activities.

STUDY SITES

During the 2013 breeding season, BCVI territory surveys were primarily conducted on the Jollyville Unit, which is owned and managed by Travis County and is part of the Cypress Creek Macrosite of the BCP (Figure 2). BCVI territory surveys were also conducted on the Ribelin tract. Additional secondary locations were checked periodically for presence/absence

of BCVIs on other areas of the Jollyville Unit, the Lake Travis Bluffs subsection of the Lucas tract and Steiner Ranch Preserve (Figure 2).

The Jollyville Unit is comprised of 1,875 acres (759 ha) and includes the following tracts: Bunten, Collins, Cuevas, Cuevas East, Grandview Hills, Nootsie, Snowden, Vireo Ridge, and Vista Point (Figure 2). The Jollyville Unit is located approximately 13 miles (21 km) northwest of downtown Austin. Both Golden-cheeked warbler (*Setophaga chrysoparia*, hereafter GCWA) and BCVI inhabit this unit. Topography includes upland plateaus that give way to irregular, steep slopes and ravines. Ravines drain into an unnamed tributary of Lake Travis (Colorado River) or into Cypress Creek. Drainages tend to flow from the east to west. The Travis County soil survey shows that riparian soils in these drainages are composed primarily of soils of the Volente complex; Brackett and Tarrant soils are found on steep slopes (USDA 1974). Tarrant soils also occur in level upland areas.

The Jollyville Unit contains closed canopy, oak-juniper (*Quercus sp.-Juniperus ashei*) woodlands, which cover the majority of the canyons and slopes. Historic harvest of mature Ashe juniper has allowed shrubby, secondary-growth junipers to dominate much the uplands and slopes. Open grasslands are found in some valleys and ridge tops, and riparian vegetation, which is dominated by black walnut (*Juglans nigra*), sycamore (*Platanus occidentalis*) and elms (*Ulmus spp.*), occupies riparian areas along creeks and drainages.

The Lucas tract, which includes the Lake Travis Bluffs subsection, totals 297 acres (120 ha) located approximately 1.5 miles (2.4 km) northeast of Mansfield Dam that impounds Lake Travis (Colorado River). Primary access points are either on RM 620, which bounds the property to the south, or Comanche Trail, which bisects the property into eastern and western sections. The Lucas tract is part Lake Travis Unit of the Cypress Creek Macrosite.

Topography includes upland plateaus, steep slopes and ravines. Ravines drain directly into Lake Travis on the western portions of the property and into Bullick Hollow Creek, a tributary of Lake Travis, on the eastern portion. The Travis County soil survey defines the surface soil types as part of the Brackett Association (USDA 1974). The uplands are dotted with karst features, including caves and sinks.

Vegetation types found on the Lucas tract are generally similar to those on the Jollyville Unit. Prior to Travis County ownership, small portions of this tract were cleared for livestock pens and hunting lanes. Malta starthistle (*Centaurea melitensis*), Chinaberry (*Melia azedarach*) and Roosevelt weed (*Baccharis neglecta*) are common in these disturbed areas. The Lake Travis Bluffs section, acquired in 2011, is an 18.5 acre parcel that was previously

cleared for development. Subsequently, most of the entire area has grown into excellent BCVI habitat dominated by shin oak (*Quercus sinuata*), sumacs (*Rhus* spp.) and Texas redbuds (*Cercis canadensis*).

The Ribelin tract is located within the Bull Creek macrosite (Figure 2). This 319-acre tract is located off of RM 2222 and McNeil Drive, which is the primary access point. The tract is located between Travis County's Sam Hamilton East tract and the City of Austin's Kent Butler tract and the Upper Bull Creek Unit. The tract contains a short section of Bull Creek, and the topography includes upland plateaus that give way to irregular, steep slopes and ravines. Primary soils on this tract are found in the Tarrant series (USDA 1974). Closed canopy oak-juniper woodlands cover the majority of the canyons and slopes. Humans have heavily impacted the lands comprising the Ribelin tract. There are several ranch roads, a substantial power line corridor (which makes up the south boundary of the property line), man-made clearings, old dumps, and fences found throughout the tract. In recent history, the land was utilized for cattle and livestock ranching.

The Steiner Ranch Preserve comprises five separate tracts totaling 819 acres (331 ha), and is located approximately nine miles (14 km) west of downtown Austin on RM 620 (Figure 2). The property is contiguous to the City of Austin's BCP Cortaño tract. Topography of the four northern tracts consists of upland hills incised by a number of draws or drainages. The southernmost section of the Steiner Ranch Preserve encompasses three steep, wooded canyons. Here, preserve property interdigitates with residential development that is situated on canyon divides. Creeks in the canyons drain southward into Lake Austin, and many of their tributaries are intermittently spring-fed. The preserve is bordered to the south by Lake Austin with 2100 feet (640 m) of river frontage. Brackett series soils predominate on rolling uplands and gentle slopes while Tarrant series soils occur on steep slopes and in canyons (USDA 1974). Vegetation ranges from open juniper brakes on uplands and shallow slopes to closed canopy juniper-oak woodlands on steeper, mesic slopes. Existing BCVI habitat occurs in limited quantity along areas adjacent to RM 620 and the City of Austin's BCP Cortaño tract. Historically, both areas have had significant BCVI populations.

HABITAT RESTORATION

Beginning in FY2001, and continuing every winter thereafter, Travis County has conducted BCVI habitat restoration within BCVI Habitat Management Areas (HMAs) (Figure 3). These HMAs are located within Travis County BCP lands and they have been designated as having the potential to be restored to BCVI habitat. HMA locations are targeted based on

known historic vireo occupancy and soil and vegetative components necessary for vireo habitat. More HMAs will be developed as additional land with restoration potential is acquired.

Poor quality BCVI habitat has been altered through a variety of techniques to create the patchy, early to mid-successional physiognomy associated with BCVI breeding habitat. By selectively removing undesirable monoculture woody species such as Ashe juniper, the growth and shrubby structure of other woody species can be improved. The following woody species benefit from Ashe juniper removal: shin oaks (*Quercus sinuata*), possumhaw (*Ilex decidua*), yaupon (*Ilex vomitoria*), Texas redbud (*Cercis Canadensis* var. *texensis*), wafer-ash (*Ptelea trifoliata*), Carolina buckthorn (*Frangula caroliniana*) and sumacs (*Rhus* sp.). Several sections of habitat, particularly those restored from 2001 to 2004, have become good to excellent quality habitat. It has been observed on the Jollyville HMA that BCVIs begin occupying restored areas three to five years following initial habitat manipulation.

In the winter (January/February) of 2013, an area originally restored in 2001 on the north end of the Vireo Ridge tract was revisited in an effort to create lanes in existing habitat to create openings in areas where shin oak, Ashe juniper and other vegetation had become too dense, filling in desirable spaces in the habitat. Additionally, a new area of approximately 6.61 acres (2.68 ha) also on the Vireo Ridge tract was mechanically manipulated with a goal to primarily remove dense stands both living and dead Ashe juniper and to allow a crew to access the area for more refined hand-clearing work. These actions increased the cumulative total of restored habitat on Travis County managed lands to approximately 149.94 acres (60.68 ha).

Follow up clearing is required to maintain BCVI habitat at an early to mid-successional stage. In most previously manipulated areas, much of the refined hand clearing is completed in subsequent years rather than at the onset of initial larger scale brush removal. Portions of areas cleared in 2001-2003 are beginning to grow out of ideal BCVI habitat and will require additional maintenance in the near future as was done in winter 2013. Other locations being considered for targeted habitat restoration in the future include areas on the Vireo Ridge, Lucas, Ribelin, New Life and Cuevas East tracts due to their history of occupancy and proximity to currently occupied habitat.

Restoration activities will continue where habitat potential has been identified on the HMAs. Target areas for restoration vary from year to year based primarily on the following: habitat utilized by BCVIs during the preceding breeding season, presence of occupied golden-

cheeked warbler habitat, diversity of desired woody species, and available budget. Travis County staff utilizes a flexible multi-year BCVI habitat restoration plan which defines areas targeted for restoration and allows for additional areas to be added or removed based on new land acquisitions, changes in land use and updated management techniques and recommendations.

METHODS

Data Collection

Detailed protocol for BCVI territory mapping, nest monitoring, and presence/absence surveys are described in an unpublished report by Travis County (2009). In FY 2013, territory mapping was used to estimate BCVI abundance and number of individual territories present. All observations (both visual and auditory) of male, female and juvenile BCVIs were plotted on hard-copy, digital ortho-photo maps with a scale of 1:3,000 or less. The following data were recorded in the field for each observation: location, date, behavior, sex, age, presence of a mate, number of fledglings and color band combination (if banded). BCVI locations and corresponding data were later recorded into an ArcGIS 10 (ESRI, Inc., Redlands, CA) geodatabase with the Texas State Plane (with NAD 1983 projection) coordinate system. All males encountered were assigned a unique number (“territory number”) to signify them as individuals. Female locations were either recorded as independent locations or with the corresponding territory number of a territorial male where applicable.

Territory mapping methods generally followed International Bird Census Committee (IBCC) guidelines (1970). Bibby’s (2000) “consecutive flush” method was employed to increase accuracy in assigning observations of BCVIs to specific territories (“clusters”). However, Bibby’s method was modified to be less intrusive in order to avoid harassment and/or human induced behaviors (Holiman and Craft 2000). No more than 10 locations for an individual bird were mapped at one time. The presence of returning color-banded BCVI allowed identification of particular individuals in many cases. When band status was unknown or when dealing with unmarked BCVI, conspecific singing or counter-singing was used to differentiate between males. BCVIs that could not be positively identified were designated as “unknown.” Playback tapes of BCVI vocalizations were used infrequently late in the season in accordance with USFWS protocol to elicit BCVI responses.

Pairing status of male BCVIs was determined by observing one or more of the following conditions: a male associating with a female, an active nest associated with a male, and/or a

male tending at least one fledgling. If any of the criteria for pairing success was met or if a male was observed in the same general location on at least three different occasions with at least a week between observations, it was considered to have established a breeding territory.

Nests were located opportunistically during normal territory mapping surveys. Disturbance was minimized by refraining from intensive nest searches. When found, nests were checked every five to seven days from the date of discovery until an outcome could be determined. Nest stage, contents, location and behavior of the attending adult were recorded during each nest check. In territories where no nest was found, but fledglings were present, staff recorded the maximum number of fledglings observed being attended. Fledglings observed being tended by a male or female confirmed breeding success within a territory; the total number of fledglings observed at any one time was used as a conservative measure of productivity.

In addition to the territory mapping work conducted on the Jollyville Unit, presence/absence surveys were conducted at the following seven additional sites: 1) a portion of Vireo Ridge (Jollyville Unit) referred to as “35 acres” that had been restored in both 2006 and 2007; 2) the east-west running ridge of the Vista Point tract (Jollyville Unit), referred to as “Coffee Cup Ridge” that was restored in 2008; 3) an area on the Ribelin tract that was occupied by a BCVI in 2009; 4) areas along a power line easement on the Ribelin tract that were restored in 2009 and 2010; 5) one of the two previously restored areas in the Steiner Ranch Preserve; 6) a previously occupied area in 2009 and 2010 on the Cuevas East tract; and 7) the Lake Travis Bluffs section of the Lucas tract (Lake Travis Unit) that was occupied in 2011. Survey efforts on the Vista Point and Lake Travis Bluffs (Lucas tract) tract actually exceeded what is required by the protocol as a result of the site being located on a GCWA survey plot. Subsequently, these locations were visited more than the minimum required five visits directed by the survey protocol.

BCVIs were surveyed for a total of 154 hours from March 23 (first detection) to July 22, 2013 (last detection). Data can be interpreted as a comprehensive census due to the relatively large amount of time spent monitoring these birds.

Banding

In an effort to build a long term demographic data set, the banding program initiated in 2008 as part of a graduate study of avian dispersal, has continued. The original project investigated interpatch dispersal patterns within a fragmented preserve network (Simper 2009). Throughout the survey season, Travis County staff updates and shares data, including banded bird resightings and nest locations in an effort to coordinate banding attempts. A total of six

adult male BCVIIs were banded in 2013. Travis County intends to continue the BCVI banding program initiated by this project.

Data Analysis

BCVI abundance is defined as the sum of all individual male BCVIIs detected at a given study site (regardless of territory status). Overall species distribution is comprised of all locations where BCVIIs were detected (i.e. registrations) and includes males, females, fledglings, and multiple sightings of the same individual. An individual male was considered to have established a breeding territory the following behaviors were observed: 1) accompanying a female, 2) tending a nest or fledglings, or 3) singing in the same locality on three separate occasions each separated by one week (i.e. six days between observations). In calculating territory number, all BCVI territories, whether they were observed entirely or partially on Travis County managed property, were considered ‘full’ territories (as opposed to ‘edge’ or partial territories). Due to limitations of time and survey effort, the set of registrations shown on attached maps do not represent a definitive description of territory boundaries.

Pairing success rate was calculated as the proportion of territories within which a female was observed or a nest was located (Anders 2000). Productivity data is represented in the following two ways: 1) the total number of fledglings divided by the total number of territories and 2) the total number of fledglings divided by the number of successful territories. A territory was considered successful if at least one fledgling was observed with a territorial male or female. The breeding success rate is the proportion of full territories that successfully fledged young (Koloszar and Becker 2000).

RESULTS

In 2013, BCVI abundance on all Travis County BCP tracts totaled 15 males. Thirteen males were observed on the Jollyville Unit (Figure 4) and two were located on the Ribelin tract (Figure 5). Eleven males established territories, with 10 of these located in areas where habitat restoration had previously occurred. The remaining four unique, unbanded males did not establish territories, possibly being transient or migrating individuals, and thus were only accounted for in abundance. It is worth noting that one of these males was observed feeding an older hatch-year and although technically could be counted as a successful territory, due the late-season observation and out of typical breeding habitat, it was only counted in abundance. No BCVI territories were established in entirely new areas on the Jollyville Unit. BCVIIs were detected in two areas slotted for presence/absence surveys: the Ribelin tract (n=2) and “35-acres” on Vireo Ridge (n=1). Table 1 presents a summary of BCVI data

collected during the 2012 breeding season in addition to data collected by various agencies exclusively on the Jollyville Unit since 1989.

In 2013, nine territories were considered successfully paired (Table 2). Six territories fledged offspring, yielding at least 19 ‘hatch year’ (HY) individuals observed in the field. Current protocol counts either the number of fledglings directly observed in the field or the number of nestlings discovered in a nest that is later demonstrated to be successful. Because of their dull-colored plumage, cryptic behavior, and unpredictable flights, we expect observer counts of fledglings to be biased low. Productivity in 2013 (Table 3), whether measured relative to successful territories (3.2 HY per terr.) or all territories (2.1 HY per terr.), is likely underestimated due to the fact that only three of six (50%) successful territories had nests that were monitored and thus exact HY totals were unknown.

Table 1. Summary of Jollyville Unit and Travis County BCVI survey data collected by various agencies, Travis County, Texas.

Year Surveyed	Agency**	Jollyville Unit Abundance	Jollyville Unit No. Territories	Total Abundance/ No. Territories (all Travis County properties)
1989	DLS	11	5	n/a
1990	DLS	11	5	n/a
1991	DLS	14	9	n/a
1992	TXDOT	Unknown ¹	Unknown	n/a
1993	TXDOT	25	20	n/a
1994	TXDOT	27	27	n/a
1995	TXDOT	23	23	n/a
1996	SWCA	19-22	15	n/a
1997	No Data	Unknown ¹	Unknown	n/a
1998	No Data	Unknown	Unknown	n/a
1999	No Data	Unknown	Unknown	n/a
2000	SWCA	3 ²	Unknown	n/a
2001	Travis County TNR	19	13	19/13
2002	Travis County TNR	21	19	21/19
2003	Travis County TNR	21	20	22/20
2004	Travis County TNR	13	12	13/12
2005	Travis County TNR	12	11	12/11

Year Surveyed	Agency**	Jollyville Unit Abundance	Jollyville Unit No. Territories	Total Abundance/ No. Territories (all Travis County properties)
2006	Travis County TNR	12	9	13/9
2007	Travis County TNR	14	13	18/15
2008	Travis County TNR	15	15	15/15
2009	Travis County TNR	13 ³	11	15/11
2010	Travis County TNR	13	11	13/11
2011	Travis County TNR	9	8	10/9
2012	Travis County TNR	9	8 ⁴	9/8
2013	Travis County TNR	13	9	15/11

*Study area is only referred to as “Jollyville Unit” since 2001. ** See Literature Cited for appropriate report citation.

¹ Restricted access on the tract.

² Detected while on brief site visit.

³ Does not include individual detected on Lake Perspectives tract (now part of the Lake Travis Unit).

⁴ One banded male established two separate, isolated territories.

Table 2. Abundance, territory number, and pairing success for BCVIs (*Vireo atricapilla*) on Jollyville Unit, Travis County, Texas, March-September 2001-2013.

Year	Total Hours Surveyed*	Abundance	No. Territories	Successfully Paired	Pair Success Rate (%)
2001	100	18 ^a	15 ^a	13 ^a	86.7 ^a
2002	179	21	19	18	94.7
2003	290 ^b	21	19 ^a	14	73.7 ^a
2004	127.5	13	12	9	75
2005	140	12	11	8	72.7
2006	146	11 ^a	9	8	88.9
2007	178	14	13	12	92.3
2008	199	15	15	14	93.3
2009	204	13 ^c	11	11	100
2010	181	13	11	11	100
2011 ^d	131	9	8	8	100
2012	141	9	8	8	100
2013	154	13	9	9	100

^a Adjusted values to reflect BCVI found only on the Jollyville Unit.

• Total hours for entire season on all properties, not only JV Unit

^b Total hours surveyed for 2003 could not be verified and may be overestimated.

^c The male located at Lake Perspectives (Lake Travis Unit) was not included in this dataset.

^d The male located at Lucas-Lake Travis Bluffs (Lake Travis Unit) was not included in this dataset.

Table 3. Breeding success and productivity for BCVI (*Vireo atricapilla*) territories on Jollyville Unit, Travis County, Texas, March-September 2001-2013.

Year	No. of territories with breeding success ¹	Breeding success rate (%)	No. Fledglings	No. fledglings/ successful territory ²	No. fledglings/ total no. territories ³
2001	4	26.7*	12	3.0*	0.8*
2002	13*	68.4*	25*	1.4*	1.3*
2003	9	47.4*	16	1.8	0.8
2004	6	50.0	13	2.2	1.1
2005	1	9.1	1	1.0	0.1
2006	8	88.9	15	1.9	1.7
2007	8	61.5	24	3.0	1.8
2008	10	66.7	29	2.9	1.9
2009	7	63.6	12	1.7	1.1
2010	8	72.7	10	1.3	0.9
2011	4	50.0	11	2.8	1.4
2012	7	87.5	21	3.0	2.6
2013	6	66.7	19	3.2	2.1

¹ Represents the number of all territories that fledged at least one young.

² Represents the average number of fledgling from territories with breeding success.

³ Represents the average number of fledgling from all successfully paired territories.

* Adjusted values to reflect BCVI found only on the Jollyville Unit.

A total of seven BCVI nests were located this year. One of these was located post-fledge. Detailed data regarding nest substrate, height, and orientation were collected post breeding season for each nest found (Table 4). Table 4 also lists the outcome for each nest identified. There was one second nest attempt observed, however it is likely that some of the territories had early failed nest attempts. Three of the six nests (50%) located and monitored successfully fledged at least one young.

Table 4. Features of BCVI nests located on Travis County BCP lands in 2013.

Substrate	Primary substrate height (m)	Concealment	Nest height (cm)	Distance from stem (cm)	Distance from foliar edge (cm)	Orientation	Comments
Shin oak (<i>Quercus sinuata</i>)	2.0	Shin oak Texas Redbud (<i>Cercis canadensis</i>) Ashe juniper (<i>Juniperus Ashei</i>)	87	57	21	East	Successful; (3HY, 1 egg unhatched)
Texas redbud (<i>Ptelea trifoliata</i>)	1.80	Shin oak Gum bumelia (<i>Sideroxylon lanuginosum</i>)	125	75	20	Southwest	Failed (4 eggs)

Substrate	Primary substrate height (m)	Concealment	Nest height (cm)	Distance from stem (cm)	Distance from foliar edge (cm)	Orientation	Comments
Texas oak (<i>Quercus buckleyi</i>)	2.5	Shin oak Texas persimmon (<i>Diosperos texana</i>)	79	90	23	Northeast	Successful second nest attempt; (4 HY)
Texas oak	8.0	Texas oak Shin oak	143	63	30	Northwest	Successful; (3 HY)
Evergreen sumac (<i>Rhus virens</i>)	2.0	Evergreen sumac Texas redbud	51	90	9	North	Successful (4 HYS)
Shin oak	1.75	Shin oak Ashe juniper	80	13	11	Northwest	Failed; (4 HY)
Shin oak	uk	Shin oak	uk	uk	uk	uk	Failed; (3 eggs) Nest lost before data collected

Definitions: Substrate: plant species in which the nest is located.

Concealment: plant species or other substrates that is primarily responsible for concealing the nest.

Orientation: compass direction of nest relative to its substrate.

In all, a total of nine individual adult BCVIs wearing color bands were observed on Travis County properties in 2013. Six adult males were banded in the 2013 field season. One additional male BCVI (banded in 2011) and two additional female BCVIs (banded in 2009 and 2012) were also observed this year. Adult males showed a 16.7% return rate (one of six banded males observed in 2012). The one returning male occupied the same area it held in 2012. Both banded females observed in 2012 returned in 2013, hence a 100% return rate of females. Nestlings were not banded due to permit restrictions.

Prior to 2008 there was no banding program in place, precluding staff from determining return rates, recruitment and associated data. From 2003 to 2009 BCVI territory and abundance numbers slowly declined despite a period of growth in 2007 and 2008. In 2013, at least three ‘second year’ males, i.e. males in their first reproductive season, established territories on tracts managed by Travis County. Table 5 summarizes relevant demographic information since 2010.

- Proportion of SY males (pSY): The proportion of second year males has been used as an indicator of recruitment. A minimum pSY value (29%) has been suggested as a measure of a stable population (USFWS 1996a). In 2013, the overall pSY was at least 57.1% (four of seven males). Specifically on the Jollyville Unit, pSY was 40.0% (two of five males).
- Site fidelity: In 2013, one of six banded males observed in 2012 returned indicating a 16.7% return rate. Females showed a 100% return rate (2 of 2).

Table 5. Proportion of second-year males (pSY) and site fidelity on Travis County BCP, Travis County, Texas. 2010-2013.

Year	pSY	Site Fidelity (males)	Site Fidelity (females)
2010	27.3	70.0	n/a
2011	20.0*	25.0	n/a
2012	28.6**	66.7	50.0
2013	57.1	16.7	100.0

* conservative number, at least three males were unsuccessfully aged.

** conservative number, one male was unsuccessfully aged.

DISCUSSION

Both overall abundance and the number of territories increased from the 2012 season's totals. On the Jollyville Unit in 2012, seven males established eight territories. In 2013, there were 13 unique males detected with nine establishing territories. Additionally, two territories were found on the Ribelin tract marking an overall increase of territorial males on Travis County BCP and matching the greatest abundance and most territories on all Travis County BCP since 2009 (15 unique males and 11 territories). The cause of the increase in BCVI numbers is unclear, but normal population fluctuations, the easing of the drought, changes in migration patterns through the area, and improved habitat could be factors.

On the Jollyville Unit, pairing success has stayed at 100% for the fifth straight year and marked the seventh straight year of greater than 90% pair success. Overall productivity (3.2 fledged offspring per full territory) was the highest level recorded since monitoring was initiated in 2001. Productivity for the total number of successfully paired territories (2.1 fledglings per full territory) was the second highest on record (since 2001).

Survey effort (17.1 hours/territory) was similar to the average effort (17.2 hours/territory) in the previous four seasons (2009-2012). The amount of survey hours in 2013 was slightly

higher than 2012, by 13 hours. Survey effort is dependent on the survey team's ability to acquire pairing and productivity data then on BCVI abundance and territories.

Several factors may influence territory distribution, including the intrinsic habitat characteristics of the site, the age structure of the population, overall population density, and habitat restoration activities in protected areas (Grzybowski et al. 1994; Anderson and Gutzwiller 1996). Territory establishment in 2013 occurred in the same general core areas on the Jollyville Unit as in previous years (Travis County 2001-2012). Although the same areas are being utilized, often by returning males (documented by resighting of banded birds), the distribution of BCVI territories on the Jollyville Unit has changed each year. An area of special note is a portion of Vireo Ridge referred to as "35-acres". This portion was occupied by two BCVIs in 2003 and 2004. In 2005 a lone BCVI was detected once and but did not establish a territory. Because this area was growing out of habitat it was restored in winter 2005. It appeared to have grown back into suitable habitat by 2009 and was finally re-occupied by a successfully paired male in 2013.

Habitat loss and degradation is a primary concern for BCVI recruitment onto Travis County BCP properties. Typical BCVI nesting habitat was uncommon on the Jollyville Unit when first acquired by Travis County in 2000 and 2001. Habitat change through vegetational succession dominated primarily by encroaching Ashe juniper reduced canopy openings; when there is sufficient shrubby deciduous cover these openings are generally associated with high quality BCVI habitat. Additionally, the successional change in vegetation structure tends towards a closed canopy woodland, rather than the low, shrubby, mid-successional stage preferred by BCVIs. Through mechanical efforts of BCVI habitat restoration, significant portions of the Jollyville Unit HMA now show characteristics of prime BCVI habitat.

All of the 2013 BCVI territories on the Jollyville Unit were established primarily in previously manipulated areas which may be considered "restored". This has been the observed trend since 2006. These observations indicate that BCVIs continue to respond positively to habitat restoration efforts undertaken since 2001 when it appeared that the remaining BCVIs were shifting annually from lesser quality habitat into higher-quality restored areas. It should be noted, however, that large areas of apparently restored habitat still have not been reoccupied and other areas that, although have been occupied, appear to have enough space for additional territories. Numerous factors influence territory establishment, but regional natural population fluctuations, declining connectivity, as well as the location of the preserve on the far eastern edge of BCVI range are all likely to contribute to overall

population trends. It is worth mentioning that although 2013 was a wetter year than 2012, the general prolonged drought over the last few years is likely negatively impacting the population. These impacts may include decreased habitat suitability e.g., decreased invertebrate population or sparse vegetation cover, which in turn could affect reproductive success.

In general, BCVIs tend to be “semi-colonial” and establish territories near other BCVIs (Ward and Schlossberg 2001). However, isolated territories composed of either individual pairs or small-clusters have occasionally been located (Grzybowski 1990). These territories are often difficult to detect as noted by Ward and Schlossberg (2001). They found that in low-density populations of BCVIs, song rates and duration of song bouts were much lower than in high-density populations. Thus, low detection rates of these isolated territories may affect estimates of abundance.

Continued research and monitoring of BCVI on the Jollyville Unit is essential to determine whether the colony is a source population or a population sink. Source populations contribute to the general overall population and help to maintain satellite colonies. Population sinks are maintained solely through immigration and contribute nothing to species-wide abundance (Pulliam 1988). Data obtained from continued banding efforts would improve estimates of inter-population connectivity as well as age-specific survival and reproduction. If adequate connectivity with neighboring sub-populations is not maintained, then BCVI numbers on isolated preserve tracts may decline precipitously, leading to local extinctions and deficient levels of colonization. Information regarding productivity and dispersal is limited because it is difficult and slow to obtain. Additional survey seasons and continued research will help gauge the effectiveness of habitat restoration projects and prioritize sites for future restoration. Without comprehensive productivity, survivorship, and dispersal information, as well as complimentary data from surrounding properties, we cannot make a definitive statement regarding the role of the Jollyville Unit within the central Texas portion of the BCVI’s range.

RECOMMENDATIONS

- Continue to conduct intensive BCVI monitoring, including annual color-banding. Such research could help address many questions concerning the long-term viability of the Jollyville Unit colony and its relationship to other sub-populations in the region. The long-term data sets generated from such studies would facilitate yearly comparisons and improve the accuracy of model-generated population forecasts. Data collected should include the following: abundance, age structure, dispersal patterns,

distribution of subpopulations, habitat associations throughout the breeding season, nest success, recruitment, return rates and age-specific measures of productivity and survivorship. Research should be focused upon answering questions of immediate relevance to management and recovery priorities.

- Collect and compile age-specific survivorship and reproductive information for marked birds. This information may provide a more accurate picture of population dynamics in cases where field data is believed to be incomplete or biased (e.g. using mean values to account for number of HYs per nest rather than number of fledglings observed in the field).
- Continue to facilitate opportunities for graduate students to collect and analyze quantitative habitat and vegetation data in order to construct habitat suitability and dispersal models. Longitudinal studies are needed to compare the results of habitat restoration treatments over time. Ideally, such data would be collected in a GIS-compatible format and at a scale that would allow preserve-wide spatial analysis. Such analyses could improve our ability to locate existing areas of high quality habitat as well as areas with high potential for successful restoration. Additionally, further research is needed to better understand dynamics of vegetative succession and its relationship to BCVI habitat suitability and reproductive success in this region.
- Refine and standardize BCVI monitoring procedures, giving special attention to minimum hours of survey and nest searching needed. This is especially important for new properties with potential BCVI habitat.
- BCVI habitat and potential habitat for restoration should continue to be identified and mapped on all tracts owned and managed by Travis County. Historic BCVI locations on properties owned and managed by Travis County should be visited regularly during the field season to determine presence/absence of BCVIs.
- Habitat restoration efforts will continue on tracts that support BCVI populations and on surrounding tracts that harbor potential habitat. Restoration methods will be evaluated to determine the best techniques for creating suitable BCVI breeding habitat.
- Create a more structured GCWA survey methodology for monitoring territories and productivity in both potential and managed BCVI habitat. Efforts should be made to document any co-occurrences of GCWA and BCVIs during the breeding season in order to investigate and evaluate the possibility of creating areas of mixed or composite habitat.

- Judicious use of recorded BCVI vocalizations should continue in accordance with USFWS protocols, especially in areas where few and/or isolated BCVIs have been detected. This recommendation is also useful to determine absence of a target species. Playback should increase detections of territorial males (Horne 2000).
- Cowbird trapping should continue on and adjacent to any Travis County-managed properties occupied by endangered songbirds, with traps added or removed based on cowbird activity. Shooting female cowbirds in habitat is also recommended.
- Although no BCVI nest attempts failed due to red imported fire ant (RIFA) predation in 2013, control of this nuisance species should continue within restored BCVI habitat areas when warranted.

LITERATURE CITED

- Anders, A. D. 2000. Demography of golden-cheeked warblers on Fort Hood, Texas in 2000: productivity, age structure, territory density, and adult return rates. In Endangered species monitoring and management at Fort Hood, Texas: 2000 annual report. Fort Hood Project, The Nature Conservancy of Texas, Fort Hood, Texas, USA.
- Anderson, S. H., and K. J. Gutzwiller. 1996. Habitat evaluation methods. Pages 592-606 in T. A. Bookhant, ed. Research and management techniques for wildlife and habitats. Fifth ed., rev. The Wildlife Society, Bethesda, Maryland, USA.
- Balcones Canyonlands Preserve Land Management Plan . 2007. BCVI management. Chapter 8 in Tier II A, Balcones Canyonlands Management Handbook. Unpublished document. Travis County, Texas, USA.
- Bibby, C. J., N. D. Burges, D. A. Hill and S. H. Mustoe. 2000. Bird census techniques. Second edition. Academic Press.
- DLS Associates. 1989b. BCVI monitoring program, Travis County, Texas and vicinity, 1989. Submitted to: The Nature Conservancy of Texas, Inc. and Executive Committee of the Austin Regional Habitat Conservation Plan.
- _____. 1990a. BCVI monitoring program, Travis County, Texas and vicinity, 1990. Submitted to: The Nature Conservancy of Texas, Inc. and Executive Committee of the Balcones Canyonlands Habitat Conservation Plan.
- _____. 1992. BCVI monitoring program, Travis County, Texas and vicinity, 1991. Submitted to: The Nature Conservancy of Texas, Inc. and Executive Committee of the Balcones Canyonlands Habitat Conservation Plan.
- Farquhar, C.C. and J. I. Gonzalez. 2005. Breeding habitat, distribution and population status of the BCVI in northern Mexico. Project WER65 Final Report. U.S. Fish and Wildlife Service, Albuquerque, New Mexico.
- Graber J.W. 1961. Distribution, Habitat Requirements, and Life History of the BCVI (*Vireo atricapilla*). Ecological Monographs 31(4):313-336.
- Grzybowski, J.A. (Department of Biology, Central State University, Edmond, OK) 1990. Population and nesting ecology of the Black-capped vireo--1990. Austin (TX): Texas Parks and Wildlife Department. Report nr E-1-3. Job 29. 39 p.
- _____. 1995. BCVI (*Vireo atricapillus*). In The Birds of North America, No. 181 (A. Poole and F. Gill, editors). The Academy of Natural Sciences, Philadelphia, Pennsylvania, USA and The American Ornithologists' Union, Washington, D.C., USA.
- _____, D. J. Tazik, and G. D. Schnell. 1994. Regional analysis of BCVI breeding habitats. Condor 96: 512-544.
- Holiman, W. C., and R. A. Craft. 2000. Breeding density and productivity of the golden-cheeked warbler on Fort Hood, Texas in 1999. Pages 79-103 in Endangered Species monitoring and management at Fort Hood, Texas: 1999 annual report. Fort Hood Project, The Nature Conservancy of Texas, Fort Hood, Texas.

- Horne, J. S. 2000. Use of conspecific taped-playback to increase detectability of BCVI. Endangered species monitoring and management at Fort Hood, Texas: 1999 annual report. Revised edition. Fort Hood Project, The Nature Conservancy of Texas, Fort Hood, Texas, USA.
- International Bird Census Committee. 1970. An international standard for a mapping method in bird census work, recommended by the International Bird Census Committee. Audubon Field Notes 24 (6):722-726.
- Koloszar, J. A. 2000. Guidelines for Black-capped vireo (BCVI) Field Work. The Nature Conservancy of Texas, Fort Hood, Texas, USA.
- Koloszar, J. A. and H. M. Becker. 2000. Monitoring of the BCVI during 2000 on Fort Hood, Texas. Endangered species monitoring and management at Fort Hood, Texas: 2000 annual report. Fort Hood Project, The Nature Conservancy of Texas, Fort Hood, Texas, USA.
- Nielsen-Gammon, J. W. 2011. OCS Report: the 2011 Texas Drought. The Office of the State Climatologist, Texas A&M University, College Station, Texas.
- Oklahoma Department of Wildlife Conservation. 1999. Reproductive enhancement and population monitoring of BCVIs in Blaine County. Federal Aid Project E-45-2. May 1, 1998-April 30, 1999. Oklahoma Department of Wildlife Conservation. Oklahoma City, Oklahoma, USA. 14 p.
- Pulliam, H.R. 1988. Sources, sinks, and population regulation. American Naturalist 132: 652-661.
- Rich, T. D., C. J. Beardmore, H. Berlanga, P. J. Blancher, M. S. W. Bradstreet, G. S. Butcher, D. W. Demarest, E. H. Dunn, W. C. Hunter, E. E. Iñigo-Elias, J. A. Kennedy, A. M. Martell, A. O. Panjabi, D. N. Pashley, K. V. Rosenberg, C. M. Rustay, J. S. Wendt, T. C. Will. 2004. Partners in Flight North American Landbird Conservation Plan. Cornell Lab of Ornithology. Ithaca, NY. Partners in Flight website. http://www.partnersinflight.org/cont_plan/ (VERSION: March 2005).
- Sibley, D. A. 2001. The Sibley Guide to Bird Life and Behavior. Alfred A. Knopf, Inc. New York. 587 p.
- Simper, W.S. (Department of Biology, Texas State University, San Marcos, TX). 2009. Black-capped vireo (*Vireo atricapilla*) color banding and surveying on the Balcones Canyonlands Preserve and the Balcones Canyonlands National Wildlife Refuge: Project Year 2. Austin (TX): USFWS. Report nr TE168189-0-2009. 32 p.
- SWCA 1996. Master BCVI survey map, Grandview Hills Parcel 13. Unpublished document. Travis County, Texas, USA.
- Texas Department of Transportation. 1992. BCVI monitoring program, northwest Travis County, Texas. Unpublished report.
- _____. 1993. BCVI monitoring program, northwest Travis County, Texas. Unpublished report.
- _____. 1994. BCVI monitoring program, northwest Travis County, Texas. Unpublished report.
- _____. 1995. BCVI monitoring program, northwest Travis County, Texas. Unpublished report.
- _____. 2001. Monitoring of the golden-cheeked warbler 2001 field season. Unpublished report.
- _____. 2001. Status of the BCVI on the Vireo Ridge Tract, Travis County, Texas, 2001 field season. Unpublished report.
- _____. 2002. Monitoring of the BCVI, 2002 field season, Travis County, Texas. Unpublished report.

- _____. 2003. Monitoring of the BCVI, 2003 field season, Travis County, Texas. Unpublished report.
- _____. 2004. Monitoring of the BCVI, 2004 field season, Travis County, Texas. Unpublished report.
- _____. 2005. Monitoring of the BCVI, 2005 field season, Travis County, Texas. Unpublished report.
- Travis County Natural Resources and Environmental Quality Division. 2006. Monitoring of the BCVI, 2006 field season, Travis County, Texas. Unpublished report.
- _____. 2007. Monitoring of the BCVI, 2007 field season, Travis County, Texas. Unpublished report.
- Travis County Natural Resources and Environmental Quality Division. 2008. Monitoring and Management of the BCVI (*Vireo atricapilla*) in Western Travis County, Texas: 2008 field season, Travis County, Texas. Unpublished report.
- _____. 2009. Monitoring and Management of the BCVI (*Vireo atricapilla*) in Western Travis County, Texas: 2009 field season, Travis County, Texas. Unpublished report.
- _____. 2010. Monitoring and Management of the BCVI (*Vireo atricapilla*) in Western Travis County, Texas: 2010 field season, Travis County, Texas. Unpublished report.
- _____. 2011. Monitoring and Management of the BCVI (*Vireo atricapilla*) in Western Travis County, Texas: 2009 field season, Travis County, Texas. Unpublished report.
- _____. 2012. Monitoring and Management of the BCVI (*Vireo atricapilla*) in Western Travis County, Texas: 2010 field season, Travis County, Texas. Unpublished report.
- U.S. Department of Agriculture. 1974. Soil survey of Travis County, Texas. United States Department of Agriculture, Soil Conservation Service, Washington, D.C. 123pp.
- U.S. Fish and Wildlife Service. 1991. BCVI population and habitat viability assessment report. Compiled and edited by Carol Beardmore, Jeff Hatfield, and Jim Lewis in conjunction with workshop participants. Report of a September 18-21, 1995 workshop arranged by the USFWS in partial fulfillment of U.S. National Biological Service Grant No. 80333-1423. Austin, Texas. Pp ix + 57.
- _____. 1996a. BCVI (*Vireo atricapillus*) recovery plan. U.S. Fish and Wildlife Service, Austin, Texas, USA.
- _____. 1996b. Federal Fish and Wildlife Permit No. PRT-788841.
- _____. 1996c. Habitat Conservation Plan and Final Environmental Impact Statement. U.S. Fish and Wildlife Service, Albuquerque, New Mexico, USA.
- Verner, J. 1985. Assessment of Counting Techniques. *Current Ornithology*. 2: 247-302.
- Ward, M. and S. Schlossberg. 2001. Conspecific attraction in BCVIs. 2001 Annual Report. Natural Resources Branch. Endangered Species Management Program, Ft. Hood, Texas
- Wilkins, N., R. A. Powell, A. A. T. Conkey and A. G. Snelgrove. 2006. Population Status and Threat Analysis for the BCVI. Department of Wildlife and Fisheries Sciences, Texas A&M University.









